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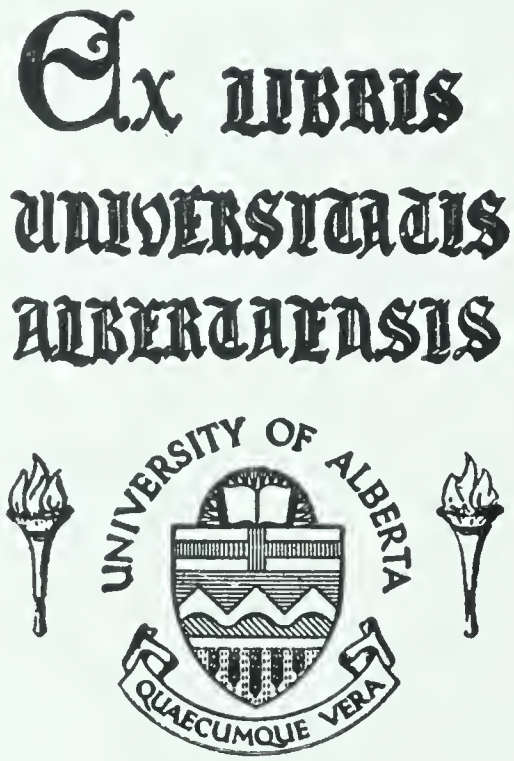

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THE UNIVERSITY OF ALBERTA

A STUDY OF CERTAIN CHARACTERISTICS OF TEACHERS IN RELATION TO GRADE IX SOCIAL STUDIES ACHIEVEMENT

by

WESLEY PERCY EDDY

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES

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ABSTRACT OF THESIS

The purpose of this study was to measure teacher effectiveness by using the methods of chi-square and analysis of variance to see if any of certain selected individual and situational characteristics of Grade IX social studies teachers in Alberta reflected any significant differences in the results of their students on the Grade IX final social studies examination in 1957-58. The study also investigated the differences in these same characteristics between teachers in city and non-city schools.

The data on teachers were obtained from the Alberta Royal Commission on Education Survey of Alberta Teacher Force through the Alberta Advisory Committee on Educational Research. The data on student achievement were gathered from the records of the Alberta Department of Education. The matching of students with teachers was done through correspondence with the principals of the schools concerned. The social studies marks were adjusted to remove the effects of mental ability.

This investigation found a significant positive relation between Grade IX social studies marks and these characteristics of teachers: number of years of training, number of university-level courses taken in the social studies, number of years of teaching experience, number of teachers in the school, and subject-field preference.

There was no significant relation between social studies marks

and the other characteristics of teachers investigated: age, median-sized class, hours per week devoted to the teaching job, and sex.

City teachers of social studies surpassed non-city teachers in number of years of training, number of students in the median-sized class, number of teachers in the school, and subject-field preference for teaching. There was not a significant difference between the two groups of teachers relative to the other characteristics investigated: number of university-level courses taken, number of years of teaching experience, age, number of hours per week devoted to teaching, and sex.

This study also found that city students made significantly higher marks in social studies than non-city students.

ACKNOWLEDGEMENTS

The author wishes to acknowledge the assistance given him by the Alberta Advisory Committee on Educational Research, the Alberta Department of Education, and the principals and teachers who helped in making available the data for this study.

Particular thanks must go to the members of the thesis committee: Dr. J. D. Ayers; Professor E. R. Moore; Dr. H. S. Baker, the original chairman of the committee, who is now Dean of Education, University of Alberta, Calgary; and Professor G. L. Berry, the present chairman.

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CHAPTER I

THE PROBLEM

I. INTRODUCTION TO THE PROBLEM

There appears to be general agreement that the position of the teacher is paramount in the teaching process[1] and that quality of teachers is one of the most important factors in the success or failure of education.[2]

The measurement of pupil achievement is a logical technique for measuring the productiveness of the teacher. Barr states that the change produced in pupils, measured in terms of the objectives of education, is the ultimate criterion of teaching success.[3]

Changes produced in pupils may be variously defined in terms of different objectives of education. These changes may be attitudinal, or they may be results which can be objectively measured on a terminal examination.

At least one study indicated that the Alberta Department of Education Examinations in Grade IX are valid measures of educational

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[1]Joseph R. Ellis, "Relationships Between Aspects of Preparation and Measures of Performance of Secondary Teachers of the Social Studies," Journal of Educational Research, LV (September, 1961), 24.

[2]Report of the Royal Commission on Education (Edmonton: Government of Alberta, the Queen's Printer, 1959), p. 180.

[3]A.S. Barr and others, The Measurement of Teaching Ability (Madison, Wisconsin: Denbar Publications, Incorporated, 1945), p. 2.

achievement.[4]

II. STATEMENT OF THE PROBLEM

This study attempted to compare certain objectively measured factors with teacher effectiveness by comparing certain measurable characteristics of the Grade IX social studies teachers in Alberta, classified according to various individual and situational factors, with the results of their students on the Social Studies IX final examination of 1958. The following characteristics were investigated in this study: (1) the extent of total academic and professional preparation beyond high school; (2) the number of university-level courses taken in the social studies; (3) years of teaching experience; (4) age; (5) the enrolment of the median-sized class taught; (6) the hours per week devoted to the teaching job, whether this be work done at home, at school, or elsewhere; (7) the number of teachers in the school; (8) the sex of the teacher; and, (9) the teachers' subject-field preference for teaching.

The Main Problem

The main problem was whether any of the above characteristics of the Grade IX social studies teachers reflected any significant differences on the results of their pupils on the Grade IX final social studies examination.

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[4] D.B. Black, "The Prediction of University Freshman Success Using Grade IX Departmental Examination Scores," Alberta Journal of Educational Research, V (December, 1959), 234.

The Subsidiary Problems

There were also two subsidiary problems to be explored. (1) Were there any significant differences in the above characteristics between teachers in city schools and teachers in non-city schools? (2) Were there any significant differences of students' results on the Grade IX social studies examination between students in city schools and students in non-city schools?

III. BACKGROUND

This study parallels to some extent work done by Mr. S.A. Lindstedt on teacher qualifications and pupil achievement on the final examination in grade nine mathematics,[5] and a further one done by Mr. E. Wasylyk in the field of mathematics in Grade XII,[6] both of whom used the same basic materials and investigated some of these same factors. For the purpose of comparison of findings, much of the procedure was the same as used in these studies.

IV. IMPORTANCE OF THE STUDY

The determination of teacher characteristics, competencies, and effectiveness poses one of the most crucial problems facing educators

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[5]S.A. Lindstedt, "Teacher Qualifications and Grade IX Mathematics Achievement" (Unpublished Master's thesis, The University of Alberta, Edmonton, 1960).

[6]E. Wasylyk, "The Relation Between Four Selected Teacher Characteristics and Student Achievement in Grade Twelve Mathematics" (Unpublished Master's thesis, The University of Alberta, Edmonton, 1961).

today. There are many predictions made in the course of selecting and recruiting persons to be trained as teachers, in the education of teachers, and in the placement, employment, and payment of teachers. In view of the fact that current predictions and ratings of teacher effectiveness have been shown to be generally unreliable, the need for a study of the present kind involving the various aspects of teaching ability is clearly indicated.[7]

Most investigators seem to feel that the various aspects of teaching ability should be studied independently before an attempt is made to study such abilities in the composite.[8] A study of this kind in social studies together with the ones by Lindstedt[9] and Wasylyk[10] in mathematics might lead to some more definite conclusions about teachers in Alberta.

V. LIMITATIONS OF THE STUDY

This study was limited to teachers in Alberta schools who completed and returned the Alberta Royal Commission on Education questionnaire of May, 1958, and who checked item 25(4) to indicate that they were teaching Grade IX social studies.

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[7] A.S. Barr and others, "Wisconsin Studies of the Measurement and Prediction of Teacher Effectiveness: A Summary of Investigations," Journal of Experimental Education, XXX (September, 1961), 8.

[8] G. Fulkerson, "Resume of Current Teacher Personnel Research," Journal of Educational Research, XLVII (May, 1954), 678.

[9] Lindstedt, op. cit.

[10] Wasylyk, op. cit.

VI. DEFINITION OF TERMS USED

The following terms are defined as they are used in this study.

Grade IX social studies final examination. The Grade IX social studies final examination of June 1958, prepared and administered by the High School Entrance Examinations Board of the Department of Education of Alberta was the terminal examination in social studies. This examination was written by all Alberta Grade IX students.

Grade IX social studies results. The results of the Grade IX social studies examination were added to the principals' ratings and then reported in stanine scores from one to nine, but adjusted as discussed in Appendix C.

Stanines. A stanine scale is an approximately normal transformation, only nine score categories being allowed.

> The percentage of cases in the stanine-score categories from 1 to 9 are 4, 7, 12, 17, 20, 17, 12, 7, and 4. . . . Stanine scores correspond to equal intervals in standard deviation units on the base line of the unit normal curve.[11]

Ability test. A test is given by the High School Entrance Examinations Board of the Department of Education of Alberta to measure the ability of Grade IX students. The test given in 1958 was

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[11] G.A. Ferguson, Statistical Analysis in Psychology and Education (Toronto: McGraw-Hill Book Company, Incorporated, 1959), p. 223.

the School and College Ability Test (SCAT).

City teachers. Teachers who checked Item 11 B(1) or Item 11 B(6) on the Alberta Royal Commission on Education, Survey of Alberta Teacher Force questionnaire were the city teachers.

Non-city teachers. Teachers who checked any other section of Item 11 on the above questionnaire, that is Item 11A, 11 B(2), 11 B(3), 11 B(4), 11 B(5), 11 B(7), 11 B(8), or 11 B(9), were classed as non-city teachers.

Teacher characteristics. The term teacher characteristics as used in this investigation included the situational factors of size of school and size of median class as well as individual factors such as age and teaching experience.

CHAPTER II

REVIEW OF THE LITERATURE

Teacher competence can be measured in terms of three criteria: the product factor, the process factor, and the presage factor.[1] Teacher competence is very commonly guessed at or predicted by pseudo criteria or presage. A great deal of research has been done on measuring those aspects of teacher and student behavior which are believed to be worthwhile in their own right, or the process factor. The third way of measuring teacher competence is in terms of the product factor or changes in terms of the student. This review will contain only a summary of the work done using pupil change as the criterion of teacher competency.

Many of the studies reviewed here have investigated the effects of a number of different factors on teacher effectiveness. This review will, therefore, not go into much background detail of a study after it has already been reviewed under an earlier heading.

Two studies recently completed, one by Lindstedt[2] and one by Wasylyk[3] will be reviewed under a separate heading in the latter part of this chapter.

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[1]Chester Harris (ed.), Encyclopedia of Educational Research (third edition; New York: Macmillan Company, 1960), pp. 1483-84.

[2]S.A. Lindstedt, "Teacher Qualifications and Grade IX Mathematics Achievement" (unpublished Master's thesis, The University of Alberta, Edmonton, 1960).

[3]E. Wasylyk, "The Relation Between Four Selected Teacher Characteristics and Student Achievement in Grade Twelve Mathematics" (unpublished Master's thesis, The University of Alberta, Edmonton, 1961).

I. STUDIES ON ACADEMIC AND PROFESSIONAL TRAINING

Much controversy has taken place and will no doubt continue to take place over the amount of training required of teachers. Regulations have recently been changed in Alberta so that two years of training will be the minimum requirement for teacher certification. The Report of the Alberta Royal Commission on Education recommended that all teachers have a minimum of four years of university training.[4] Some will insist on even longer training for teachers and some will no doubt say that only one year of training, if any, is required. There is research evidence to support any of these points of view.

An early investigation of the relationship between teacher training and pupil achievement was made by Hughes in 1925. This study involved the pupils of physics teachers of twenty-nine schools with classes of varying size. The pupils were equated for intelligence and were given three tests of physics content. The results showed that the pupils of teachers who had specialized training in physics made average scores above the mean score of all those who took the test.[5]

In 1933, Davis investigated the relationship between training and success in getting pupils through the Minnesota State Board Tests

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[4] Report of the Royal Commission on Education (Edmonton: Government of Alberta, the Queen's Printer, 1959), p. 187.

[5] J.M. Hughes, "A Study of Intelligence and of the Training of Teachers as Factors, Conditioning the Achievement of Pupils," School Review, XXXIII (March-April, 1925), 294.

of Pupil Achievement. There were 796 teachers and 13,460 pupils involved in the study. The findings revealed that students in chemistry scored much higher if their teacher had a college major or minor in chemistry than if their teacher was without this specialized training. In all other subject fields the students scored higher if their teachers had no such specialized training in their subject.[6] No mention is made, though, regarding the validity of the State Board Tests.

Allen made a study of 120 teachers in 1938, and reported that after a relatively high minimal background had been reached in teacher training, further training at a post-graduate level did not necessarily differentiate superior from very inferior teachers.[7]

In 1945 Rostker conducted a study in which supervisors tested the pupils and rated twenty-eight seventh and eighth grade teachers in small Wisconsin schools on their pupils' gains in achievement on two units in citizenship. Among other results, knowledge of subject matter was found to be significantly associated with teaching ability.[8]

In 1946 Stephens and Lichenstein conducted a survey of eighty-six Baltimore teachers of grade five arithmetic. They reported that

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[6]H.M. Davis, The Use of State High School Examinations as an Instrument of Judging the Work of Teachers, (Teachers College Contributions to Education, No. 611. New York: Columbia University, 1934), p. 101.

[7]H.P. Allen, "Earmarks of a Good Teacher," American School Board Journal, XCVI (March, 1938), 25-26, 92.

[8]A.S. Barr and others, The Measurement of Teaching Ability (Madison, Wisconsin: Denbar Publications, Incorporated, 1945), p. 50.

C.E. (class efficiency), which was pupil growth in relation to mental age, showed a negative correlation with the teacher's knowledge of arithmetic.[9]

During 1947-48, Schunert carried out a comprehensive study of 100 Minnesota secondary schools involving 3919 pupils. The criteria of pupil gain were the Minnesota State Board Examinations. No significant association was found between the mathematics achievement of the student and the amount of teacher's mathematical training.[10]

In 1959 McCall and Krause sought to measure teacher competence of seventy-three teachers against the growth of their sixth grade pupils in North Carolina. Among the findings, they related:

> Training, an almost universally employed basis for evaluating teacher merit and fixing salaries, was somewhat better than drawing shuffled names out of a hat (r = .13).
>
> The teacher's knowledge of subject matter showed no correlation (- .06) with efficiency.[11]

A very recent study by Ellis in 1961 tried to discover relationships between aspects of the preparation of seventy secondary school teachers of the social studies in urban Texas and measures of their

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[9] J.M. Stephens and A. Lichenstein, "Factors Associated with Success in Teaching Grade Five Arithmetic," Journal of Educational Research, XL (May, 1947), 694.

[10] J. Schunert, "The Association of Mathematical Achievement with Certain Factors Resident in the Teacher, in the Teaching, in the Pupil, and in the School," Journal of Experimental Education, XIX (March, 1951), 233.

[11] W. A. McCall and G.R. Krause, "Measurement of Teacher Merit for Salary Purposes," Journal of Educational Research, LIII (October, 1959), 73.

teaching performance.

Outstanding teachers were compared with below average teachers. Rating was done by the principals and students as well as three instruments or scales. A pattern of differences was observed which strongly favored the outstanding teachers in undergraduate marks, and in mean amount of preparation in overall work as well as in the social science major. None of these findings, however, was statistically significant.[12]

II. STUDIES ON TEACHING EXPERIENCE

Teacher's salaries are based to some extent on the amount of teaching experience of teachers. It is assumed that the more experienced teacher will, up to a point, be a better teacher. There is much evidence to support this point of view but also a certain amount of evidence which contradicts the above idea.

Bathurst carried out an early investigation in which 300 teachers in fifteen school systems were studied. It was found in this 1929 study that teaching efficiency increased slightly with increased experience.[13]

Davis found that teachers with two or more years experience were more successful in having their pupils pass the Minnesota State Board

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[12] J.R. Ellis, "Relationships Between Aspects of Preparation and Measures of Performance of Secondary Teachers of the Social Studies," Journal of Educational Research, LV (September, 1961), 24-25

[13] J.E. Bathurst, "Relation of Efficiency to Experience and Age among Elementary Teachers," Journal of Educational Research, XIX (1929), 314-316.

tests than those with one year of experience. Pupils of teachers with more than two years experience were not, however, more successful than pupils of teachers with just two years of experience.[14]

Stephens and Lichenstein concluded that there was a slight positive correlation between class efficiency and years of teaching experience, especially for the younger teachers.[15]

Schunert found that classes of teachers with eight or more years of experience exceeded the achievement of classes whose teachers had less experience. No significant difference was found between classes taught by teachers having from two to eight years of experience and those with less experience.[16]

McCall and Krause found no significant difference between years of teaching experience and pupil growth.[17]

III. STUDIES ON AGE

There is controversy over whether older teachers are as competent as younger ones. The research findings relating to age of the teacher are inconclusive but generally do not favor older teachers.

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[14] Davis, loc. cit.

[15] Stephens and Lichenstein, loc. cit.

[16] Schunert, loc. cit.

[17] McCall and Krause, loc. cit.

Bathurst, in his 1929 study, found that efficiency decreased slightly with age.[18]

Rolfe attempted in 1945 to determine the relationship between the age of the teacher and the criterion of pupil change as measured by achievement tests in grade seven and eight citizenship. He found no significant relationship between the age of the teacher and pupil change.[19]

In a 1945 study by Brookover, sixty-six male Indiana high school teachers of United States history were studied. Pupil gains in information increased with the age of the teacher up to age thirty-eight after which they decreased. The greatest gains were made by pupils whose teachers ranged in age from twenty-seven to thirty-eight years.[20]

Johnson, who in 1955 investigated teachers graduating from a southern United States university, found that age of the teacher was not significant to effectiveness of teachers, although certain of its residual factors such as mannerisms, general vigor, enthusiasm, and poise were significant to effectiveness.[21]

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[18]Bathurst, loc. cit.

[19]Barr and others, op. cit. p. 74.

[20]W.B. Brookover, "The Relation of Social Factors to Teaching Ability," Journal of Experimental Education, XIII (1945), 191-205.

[21]G.B. Johnson, Jr., "An Evaluation Instrument for the Analysis of Teacher Effectiveness," Journal of Experimental Education, XXIII (June, 1955), 343.

IV. STUDIES ON TEACHER LOAD

Although the earliest studies on teaching load were in terms of hours per week, Douglass by 1928 had suggested a formula for measuring teaching load by weighting in subjects according to difficulty.[22] His revised formula of 1954 took into account the relative difficulty of the various subjects and grade levels, duplication of class materials, number of pupils, and other data.[23]

Many of the studies having to do with teacher load seem concerned with how to reduce it or make a fairer distribution of it or shift the work to teacher aides.[24]

Where there are significant differences in the research findings on class size, these differences generally favor smaller classes rather than larger classes.

A study of 5300 University of Wisconsin students was reported by Cheydleur in 1945. The report stated:

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[22]H.R. Douglass, "Measuring the Teaching Load in the High School," The Nations Schools, XI (October, 1928), 22.

[23]H.R. Douglass and K.L. Noble, "Revised Norms for High School Teaching Load," Bulletin of the National Association of Secondary School Principals, XXXVIII (December, 1954), 97-98.

[24]M.L. Hartung, "Better Utilization of the Teacher's Time," School Review, LXI (1953), 514.

> Students have a better chance of securing fair marks in classes ranging from 9 to 18 students than they have in classes ranging from 19 to 33 students. Likewise it would appear that teachers are more apt to obtain good results in a small class than they would in a large class.[25]

Anderson made a study in 1950 of pupils handled per day per teacher. He found evidence to show that students achieved significantly higher scores on the final examination in chemistry when the number of pupils handled per day per teacher was in the lower one-fourth of the distribution rather than the upper one-fourth.[26]

Spitzer investigated 179 classes in Iowa cities in 1954 and compared them with their achievement on the Iowa Every-Pupil Tests of Basic Skills. He found no significant difference between achievement by small classes of twenty-six or fewer and achievement by large classes of thirty or more pupils.[27]

Schunert's Minnesota study of 1951, reported that classes enrolling from twenty to thirty pupils exceeded the achievement of the larger classes as well as the achievement of the smaller classes.[28]

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[25] F.D. Cheydleur, "Judging Teachers of Basic French Courses by Objective Means at the University of Wisconsin: 1919-1943," Journal of Educational Research, XXXIX (1945), 182.

[26] K.E. Anderson, "The Relationship Between Teacher Load and Student Achievement," School Science and Mathematics, L (1950), 468-470.

[27] H.F. Spitzer, "Class Size and Pupil Achievement," Elementary School Journal, LV (October, 1954), 84-85.

[28] Schunert, loc. cit.

V. STUDIES ON SCHOOL SIZE

Centralization of schools has brought along with it arguments over the relative merit of schools of different sizes. In the few investigations of school size in relation to pupil growth, the findings generally favored larger schools up to a certain point.

Rolfe's 1945 investigation reported that the factor of school size appeared to possess significance in relation to pupil change in grade seven and eight citizenship. He concluded:

> There appears to be considerable evidence that the teacher in rural schools contributes less to pupil success than teachers in schools where a single grade is to be taught.[29]

Schunert in 1951 found that classes in schools enrolling from 100 to 500 pupils exceeded the achievement of classes in larger and smaller schools.[30]

VI. STUDIES ON SEX

There has been so little actual research on this factor as to lead A.S. Barr to say in 1961 that:

> There has been little, if any, evaluation of sex differences in teaching effectiveness as such. We have sub-implications; that males, or females, not only are

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[29] Barr and others, loc. cit.

[30] Schunert, loc. cit.

> as effective with girls as with boys; but that they are equally as effective at each grade level, in each content subject, and so on.[31]

The study by Cheydleur at the University of Wisconsin reported in 1946 that students of women instructors seemed to achieve slightly more although the evidence was too close to be very conclusive.[32]

VII. ALBERTA STUDIES

Lindstedt[33] investigated the competence of Grade IX mathematics teachers while Wasylyk[34] investigated the competence of Grade XII mathematics teachers who were teaching in Alberta schools in May, 1958. Both sought to determine the relationship between training, experience, number of university-level mathematics courses taken, and subject-field preference for teaching of Alberta mathematics teachers and the achievement of the students of these teachers on the final examinations in mathematics.

Lindstedt did not, while Wasylyk did, take into account the differences in the mental abilities of the students.

Lindstedt found no significant relationship between the academic and professional training of teachers and the mathematics achievement

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[31] A.S. Barr and others, "Wisconsin Studies of the Measurement and Prediction of Teachers Effectiveness: A Summary of Investigations," Journal of Experimental Education, XXX (September, 1961), 121.

[32] Cheydleur, op. cit. p. 192

[33] Lindstedt, op. cit.

[34] Wasylyk, op. cit.

of their students up to four years of training. When the length of training exceeded four years, the relationship became significant.

Wasylyk, on the other hand, placed all teachers with less than four years of training in the first group, and found that the pupils of this group of teachers scored the lowest. In fact, each additional year of training showed up in significantly higher student achievement except that the student achievement of teachers with five but less than six years of training was not very much higher than that of teachers with four but less than five years of training.

In the matter of mathematics courses taken, Lindstedt's study showed no significant relationship between mathematics background and student achievement. Wasylyk, on the other hand, found:

> The mean of student achievement in mathematics increases very significantly as the number of mathematics courses taken by the teacher increases consistently from one or none to six or more.[35]

With regard to experience, Lindstedt found a significant relationship between teaching experience and student achievement when the length of experience was ten years or more compared to when it was one year. Teachers with five to nine years of teaching experience were more effective than teachers with three or four years of experience.

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[35] Ibid., p. 75.

Wasylyk found that mathematics achievement of students whose teachers had twenty to thirty-four years of experience was significantly better than that of any other group. The achievement of students whose teachers had ten to nineteen years of experience was significantly higher than that of students whose teachers had thirty-five or more years of experience.

When they grouped training and experience together, both Lindstedt and Wasylyk found that successive increases in the two characteristics were accompanied by an increase in student achievement.

Both Lindstedt and Wasylyk also found a very significant relationship between achievement and subject-field preference for teaching. The mathematics examination results of students whose teachers showed a preference for teaching in the mathematics-science field significantly exceeded the students of those whose preference was in some other field.

Lindstedt and Wasylyk both found that city teachers significantly surpassed non-city teachers in length of academic and professional training, and in the number of university-level courses taken, but not significantly in number of years of teaching experience.

Lindstedt found a significant difference and Wasylyk found no difference in how well the teachers were placed with respect to their subject-field preference for teaching between city and non-city teachers.

With respect to differences in actual results on the final examination, Lindstedt discovered no significant difference and Wasylyk

found there was a significant difference in that city students scored much higher than non-city students.

VIII. SUMMARY OF THE STUDIES REVIEWED

The investigations reviewed were fairly evenly divided as to the significant effect of additional training and teaching experience on student achievement. There was slightly more evidence to show that younger teachers surpassed older teachers. The studies on class size generally showed that smaller classes were better taught than larger classes. One study showed that perhaps women teachers produced better results than men. School size, up to a point, coincided with improved pupil performance. Two studies found that student achievement and teacher's subject-field preference were significantly related. The need for further research is evident.

CHAPTER III

COLLECTION OF DATA AND METHOD OF ANALYSIS OF DATA

This chapter will deal with the sources of data for both teachers and students. Certain basic assumptions regarding the data are discussed and a brief description of each sample is given. The test of representativeness and the method of adjustment of social studies scores will also be dealt with in this chapter. The chapter concludes with a brief description of the method of analysis of data.

I. METHOD OF COLLECTION OF DATA

Data on Teachers

The Alberta Royal Commission on Education used a questionnaire to make a survey of the Alberta teacher force during 1958. The questionnaire, which was returned by over ninety-nine per cent of the teachers, contained much factual information regarding the characteristics of the teachers and their schools. The social studies teachers were identified as those checking Item 25(4) of this questionnaire to indicate that they were teaching social studies in Grade IX. This study also used information from Items B4, B6, B9, B11, C15, E I 26(a), E III 40, F41, G51, and G53 of the questionnaire. (These items are found in Appendix A.)

Data on Students

The Examinations Branch of the Alberta Department of Education has on record the marks made by all Grade IX students in 1957-58 in both social studies and on the mental ability test. The Grade IX social studies results are the average of the principals' ratings and the final examination marks. The performance of each student in social studies is given as a letter grading from D to H and as a stanine from one to nine. (See Appendix B). The mental ability scores are given as both raw scores and percentiles. To facilitate the work of this study, the mental ability scores were transformed to stanine scores.

II. BASIC ASSUMPTIONS RE DATA

For the purpose of this study it was assumed that the answers reported by the teachers on the questionnaire were accurate, that the students were correctly identified with their teachers, and that the records of the Department of Education regarding student marks were accurate.

III. THE SAMPLE

The Teacher Sample

There were 710 teachers who answered the questionnaire to the effect that they taught Grade IX social studies.[1] A sample of this

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[1] R.S. MacArthur and S.A. Lindstedt, The Alberta Teacher Force in 1957-58 (University of Alberta Monographs in Education Number 3. Edmonton, Alberta: The Alberta Advisory Committee on Educational Research, University of Alberta, 1958), p. 51.

group was chosen by the following method. The sample for city teachers was chosen by drawing names of schools at random. All the teachers in these chosen schools formed the city sample. The equivalent non-city sample was chosen by first classifying the schools into groups according to the number of Grade IX students in the school as reported on the Form A card sent to the Department of Education by the principal at the start of the school year. One-eighth of the schools were drawn at random from each group. All the teachers from each of the chosen schools were included in the sample. This method was used to ensure fair representation of each size of school.

In all, ninety-seven teachers were included in the sample, or about 13.7 per cent of the total number of Grade IX social studies teachers. Of these, nineteen or about 19.6 per cent reported that they were city teachers and 78 or about 80.4 per cent reported that they were non-city teachers.

The Student Sample

The students in the schools as chosen in the above sample were used. Some students did not write the social studies examination, some did not write the mental ability examination, and some missed both examinations. These few exceptional cases were excluded from the sample. Where there was only one Grade IX social studies teacher in the school it was a simple matter to identify the student with his teacher from Department of Education records. Where there were several teachers of Grade IX social studies in a school, a letter was sent to the principal requesting that the official records of the

school be consulted to identify the pupils of each individual teacher. In several cases this was not included in the official school records, and it was necessary for the individual teachers to check their records. In such cases in schools where the individual classes were taught by different teachers, this was verified by contacting two or three students from each class and asking them to name their social studies teacher in Grade IX. Each student identification of the teacher matched the statements made earlier by the teachers, so the students were assumed to be correctly identified according to their teachers.

There were a total of 2279 students in the final sample or about 13 per cent of the total of 17,378 Grade IX students.[2] Of these, 933 or about 40.9 per cent of the sample were city students and 1346 or about 59.1 per cent were non-city students.

IV. TEST OF REPRESENTATIVENESS

Because only a sample of the total population of students was used, the total sample of students was tested for representativeness using the chi-square test of goodness of fit.[3]

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[2] Annual Report, 1958 (Edmonton, Alberta: Department of Education, Government of Alberta, the Queen's Printer, 1959), p. 68.

[3] G.A. Ferguson, Statistical Analysis in Psychology and Education (Toronto: McGraw-Hill Book Company, Incorporated, 1959), pp. 161-65.

Table I shows the calculation of chi-square in comparing the observed with the expected frequencies of this sample group of students. The expected distribution (E) is computed from the percentage of scores in each stanine as shown in Appendix B.

TABLE I

TEST OF REPRESENTATIVENESS OF TOTAL SAMPLE OF STUDENTS

	Stanine Scores on Social Studies Examination									
	1	2	3	4	5	6	7	8	9	Totals
Sample (o)	81	146	257	382	472	394	283	168	96	2279
Expected (E)	91.2	159.5	273.5	387.4	455.8	387.4	273.5	159.5	91.2	2279

$X^2 = 5.85$; df = 8; $.50 < p < .70$

The probability value is greater than .05 indicating that the observed sample distribution was not significantly different from the expected distribution.

V. ADJUSTMENT OF SCORES

Principals' ratings were used in the determination of the final mark in social studies and science in Grade IX. The final mark assigned to the student by the Department of Education in 1958 was therefore an average of the result of the final examination and the principal's confidential return mark in social studies. Several researchers have

shown that the principals' marks are an accurate prediction of final examination marks and therefore the final assigned grading and the results on the final social studies examination are not appreciably different.[4, 5]

The total mark obtained still did not take into account the individual mental ability differences of the students. The mental ability test administered in 1958 was the School and College Ability Test (SCAT). This test measures, to some extent, skills and abilities beyond academic aptitude, but it was the only available test of ability for all of the sample of students.[6] The scores used in this study are therefore the scores of social studies achievement when mental ability was held constant. (The method used in the adjustment of scores is described in Appendix C.)

VI. METHOD OF ANALYSIS OF DATA

The data for the characteristics investigated in the main problem were arranged in contingency tables and the probabilities of the distributions were calculated by chi-square tests of independence. In each

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[4] A.B. Evenson, Re: Grade IX Examinations, Curriculum Branch Circular, Edmonton, 1952. (Mimeographed)

[5] D.B. Black, "A Study of the Relationship of the Grade IX Principal's Rating to Performance on the Alberta Grade IX Departmental Examinations," Alberta Journal of Educational Research, IV (December, 1958), 284.

[6] Ibid., p. 285.

case the value of the probability, p, has been reported. If p is greater than .05 ($p > .05$) then the difference is not significant. If p is less than .01 ($p < .01$) the difference is very significant. If the value of p is between .05 and .01 ($.01 < p < .05$) a cautious interpretation is made that there is some difference between the groups.[7]

The more powerful technique of analysis of variance was also used. (The conditions underlying the use of analysis of variance are discussed in Appendix D.)

The effect of analysis of variance on adjusted scores is not as powerful as analysis of covariance, but if group regression lines are all parallel it would be approximately the same. With data of the type studied herein, and with the number of cases involved, this will be the tendency, however, so probably the procedure used is not much less powerful than analysis of covariance.

The data for the subsidiary problems were also arranged in contingency tables and the probabilities of the distributions were calculated by chi-square tests of independence.[8]

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[7] Ferguson, op. cit., pp. 165-177.

[8] Ibid., p. 240.

CHAPTER IV

ANALYSIS AND INTERPRETATION OF DATA: THE MAIN PROBLEM

The data relating to the main problem are presented in contingency tables in this chapter. The relationship between social studies marks and each specific teacher characteristic is investigated by the chi-square method and by analysis of variance. The social studies marks are grouped horizontally by stanine scores and the specific teacher characteristic is arranged vertically. Not all teachers answered all items, so the numbers vary.

As well as contingency tables, there are also tables shown giving data for analysis of variance. These tables present summaries of the examination scores. The ratio of the largest to the smallest variance, Fmax, is also reported. If the variances do not differ significantly, that is if Fmax is not large, then it is implied that any differences in populations are the result of differences in their means rather than with respect to their variances. (See Appendix D - Conditions underlying analysis of variance.)

Tables giving summaries of the analysis of variance are shown to indicate whether or not the means of the various groups are significantly different. The value of F .01 is given and the value of F .05 is also given where this is applicable. If the value of F which is given exceeds the value of F .05; then the means are significantly different.

Finally, where the F test indicates a significant difference, the means are compared using Tukey's gap test.[1]

In the two cases where there are only two means to be compared, an analysis of variance is unnecessary. In such cases t is found by simply taking the square root of F.[2]

The relationship between teaching experience and teacher training is further investigated using a two-way classification analysis of variance. This analysis brings out the individual significance of these individual teacher characteristics and also the significance of the two in combination.

I. ACADEMIC AND PROFESSIONAL TRAINING OF TEACHERS

Table II shows the students' scores on the Grade IX social studies final examination arranged according to the number of years of academic and professional training of their teachers.

The chi-square test of independence shows very significant differences among the four groups of scores, indicating that there is a strong relationship between student results in social studies and the amount of training of the teacher.

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[1] A.L. Edwards, Statistical Methods for the Behavioral Sciences (New York: Rinehart and Company, Incorporated, 1954), pp. 330-335.

[2] G.A. Ferguson, Statistical Analysis in Psychology and Education (Toronto: McGraw-Hill Book Company, Incorporated, 1959), p. 239.

TABLE II

GRADE IX SOCIAL STUDIES RESULTS CLASSIFIED BY NUMBER OF YEARS OF ACADEMIC AND PROFESSIONAL TRAINING OF TEACHERS

Years of Training	Stanine Scores on Examination									
	1	2	3	4	5	6	7	8	9	Totals
(1) One or less (less than two)	3	20	73	137	180	151	58	13	2	637
(2) Two or three (less than four)	3	17	90	174	200	195	66	15	1	761
(3) Four or five (less than six)	0	6	39	77	173	186	106	30	2	619
(4) Six or more	0	9	23	44	77	65	35	9	0	262
Totals	6	52	225	432	630	597	265	67	5	2279

$X^2 = 94.36$; df = 24; $.001 < p < .01$

Tables II (a) and II (b) present the analysis of variance data and a summary of the analysis. An F value of 27.2 shows that there are significant differences among the means of the groups. Tukey's gap test shows that a gap of .23 or greater is significant at the .05 level and a gap of .3 or larger is significant at the .01 level. There are no significant differences between Groups (1) and (2), and Groups (2) and (4). The difference in means between Groups (1) and (4) is significant at the .05 level of significance. The

TABLE II (a)

DATA FOR ANALYSIS OF VARIANCE: GRADE IX SOCIAL STUDIES
RESULTS CLASSIFIED BY NUMBER OF YEARS OF ACADEMIC
AND PROFESSIONAL TRAINING OF TEACHERS

	Number of Years of Training			
	(1) One or Less	(2) Two or three	(3) Four or Five	(4) Six or more
Number of Students	637	761	619	262
Sum of Scores	3144	3764	3418	1355
Mean	4.94	4.95	5.52	5.17
Variance	1.82	1.73	1.68	1.91

Homogeneity of Variances = Fmax = 1.14

TABLE II (b)

SUMMARY OF ANALYSIS OF VARIANCE
FOR DATA OF TABLE II (a)

Source of Variation	Sum of Squares	Degrees of Freedom	Variance
Between Means	145.23	3	48.41
Within Conditions	4054.88	2275	1.78

F = 27.2; F .01 = 3.80

differences for the other three pairs of combinations are significant at the .01 level.

Stated more specifically, there are no significant differences in social studies examination results between students of teachers with two or three (less than four) years of academic and professional training and students whose teachers had one or less or six or more years of training. The achievement of students whose teachers had four or five (less than six) years of training is very much higher than that of either group whose teachers had less training. The achievement of students whose teachers had six or more years of training is higher than the achievement of students whose teachers had one or less years of training. The achievement of students whose teachers had six or more years of training is significantly lower than that of students whose teachers had four or five (less than six) years of training.

II. NUMBER OF UNIVERSITY-LEVEL SOCIAL STUDIES COURSES

Table III shows the students' final scores in Grade IX social studies arranged according to the number of university-level social studies courses taken by the teachers.

The chi-square test brings out differences significant at the .05 level of significance.

Tables III (a) and III (b) show the data for the analysis of variance and the summary of analysis of variance. The value of F is 9.2 which is significant at the .01 level. Tukey's gap test shows that a gap of .23 or greater is significant at the .05 level and a

TABLE III

GRADE IX SOCIAL STUDIES RESULTS CLASSIFIED BY NUMBER OF UNIVERSITY-LEVEL COURSES IN THE SOCIAL STUDIES TAKEN BY TEACHERS

Number of Social Studies Courses	Stanine Scores on Examination 1	2	3	4	5	6	7	8	9	Totals
(1) None	1	9	56	115	124	130	45	11	0	491
(2) One or two	3	16	54	94	117	104	37	6	0	431
(3) Three or four	0	5	22	41	63	83	38	10	1	263
(4) Five or more	2	6	24	69	94	85	45	8	1	334
Totals	6	36	156	319	398	402	165	35	2	1519

$X^2 = 40.52$; $df = 24$; $.01 < p < .05$

gap of .3 or greater is significant at the .01 level. There are, therefore, no significant differences between Groups (1) and (2), Groups (1) and (4), and Groups (3) and (4). The other pairs of combinations show differences significant at the .01 level.

Stated more specifically, there are no significant differences in Grade IX social studies examination results between students whose teachers had no university-level social studies courses and students

TABLE III (a)

DATA FOR ANALYSIS OF VARIANCE: GRADE IX SOCIAL STUDIES
RESULTS CLASSIFIED BY NUMBER OF UNIVERSITY-LEVEL
COURSES IN THE SOCIAL STUDIES TAKEN BY TEACHERS

	Number of Courses			
	(1) None	(2) One or two	(3) Three or four	(4) Five or more
Number of Students	491	431	263	334
Sum of Scores	2450	2089	1408	1730
Mean	4.99	4.85	5.35	5.18
Variance	1.72	1.82	1.87	1.77

Homogeneity of Variances = Fmax = 1.09

TABLE III (b)

SUMMARY OF ANALYSIS OF VARIANCE
FOR DATA OF TABLE III (a)

Source of Variation	Sum of Squares	Degrees of Freedom	Variance
Between Means	49.40	3	16.47
Within Conditions	2718.17	1515	1.79

F = 9.2; F .01 = 3.80

whose teachers had one or two such courses. There is no significant difference between students whose teachers had three or four university-level social studies courses and students whose teachers had five or more such courses. The achievement of students whose teachers had five or more university-level social studies courses does not differ from the achievement of students whose teachers had no such courses. The achievement of students whose teachers had three or four social studies courses is very significantly higher than that of students whose teachers had no courses or one or two courses in social studies. The achievement of students whose teachers had five or more courses in social studies is very significantly higher than that of students whose teachers had one or two such courses.

III. YEARS OF TEACHING EXPERIENCE

Table IV shows the students' scores on the Grade IX social studies final examinations arranged according to the years of teaching experience of their teachers.

The chi-square test of independence shows very significant differences among the four groups of scores indicating that there is a strong relation between student results in social studies and years of teaching experience of the teachers.

Tables IV (a) and IV (b) present the analysis of variance data and a summary of the analysis. An F value of 12.98 shows that there are significant differences among the means of the groups. Tukey's gap test shows that a gap of .22 or greater is significant at the

TABLE IV

GRADE IX SOCIAL STUDIES RESULTS CLASSIFIED BY NUMBER OF SCHOOL YEARS OF TEACHING EXPERIENCE OF TEACHERS

Years of Experience	Stanine Scores on Examinations 1	2	3	4	5	6	7	8	9	Totals
(1) One to four	1	3	38	63	83	76	29	5	1	299
(2) Five to fourteen	1	27	99	164	256	224	95	30	3	899
(3) Fifteen to twenty-four	3	17	61	157	217	190	75	14	1	735
(4) Twenty-five and over	0	5	23	44	74	106	65	18	0	335
Totals	5	52	221	428	630	596	264	67	5	2268

$X^2 = 68.24$; $df = 24$; $.001 < p < .01$

.05 level and a gap of .29 or greater is significant at the .01 level. There are significant differences between Group (4) and all other groups. The differences between all other pairs of combinations are not significant.

Thus there are very significant differences in social studies results between the group of students whose teachers had twenty-five years of teaching experience and over, and the groups of students

TABLE IV (a)

DATA FOR ANALYSIS OF VARIANCE: GRADE IX SOCIAL STUDIES
RESULTS CLASSIFIED BY NUMBER OF SCHOOL YEARS
OF TEACHING EXPERIENCE OF TEACHERS

	Number of Years of Experience			
	(1) One to four	(2) Five to Fourteen	(3) Fifteen to Twenty-four	(4) Twenty-five and over
Number of Students	299	899	735	335
Sum of Scores	1496	4564	3719	1860
Mean	5.00	5.08	5.06	5.55
Variance	1.74	1.9	1.67	1.84

Homogeneity of Variances = Fmax = 1.14

TABLE IV (b)

SUMMARY OF ANALYSIS OF VARIANCE
FOR DATA OF TABLE IV (a)

Source of Variation	Sum of Squares	Degrees of Freedom	Variance
Between Means	70.67	3	23.36
Within Conditions	4084.91	2264	1.8

F = 12.98; F .01 = 3.80

whose teachers had less than twenty-five years of teaching experience. The results of the group of students whose teachers had twenty-five or more years of experience are higher than the results of the other groups. There are no significant differences between other pairs of combinations.

IV. AGE OF THE TEACHER

Table V shows the students' scores on the Grade IX social studies final examinations arranged according to the age of their teachers.

The chi-square test of independence shows no significant differences among the groups of examination scores. This indicates that there is no relation between Grade IX social studies results and age of teachers.

The data for analysis of variance and the summary of variance are shown in Tables V (a) and V (b). The value of F of 1.93 indicates no significant differences between student achievement and the age of the teachers.

V. ENROLMENT OF THE MEDIAN-SIZED CLASS TAUGHT BY THE TEACHER

Table VI shows the students' scores on the Grade IX social studies final examination arranged according to the enrolment of the median-sized class taught by the teacher.

The chi-square test of independence shows no significant differences between the four groups of scores. This indicates that there is no significant relation between size of class and social

TABLE V

GRADE IX SOCIAL STUDIES RESULTS CLASSIFIED
BY AGE OF TEACHERS

Age of Teacher	Stanine Scores on Examination 1	2	3	4	5	6	7	8	9	Totals
(1) Up to 30 years.	2	12	57	101	150	143	57	14	2	538
(2) 31 to 40 years	0	14	59	91	147	122	61	11	2	507
(3) 41 to 55 years	4	24	90	199	284	263	113	36	1	1014
(4) 56 years and up	0	2	19	41	49	69	34	6	0	220
Totals	6	52	225	432	630	597	265	67	5	2279

$X^2 = 23.26$; df = 24; $.50 < p < .70$

studies examination results.

The data for analysis of variance and the summary of variance are shown in Table VI (a) and VI (b). The value of F of 1.67 is not significant. This is a further indication that there is no relation between students' scores on the Grade IX social studies examination and the median-sized class taught by their teachers.

TABLE V (a)

DATA FOR ANALYSIS OF VARIANCE: GRADE IX SOCIAL STUDIES
RESULTS CLASSIFIED BY AGE OF TEACHERS

	Age of Teacher			
	(1) Up to 30 Years	(2) 31 to 40 Years	(3) 41 to 55 Years	(4) 56 years and up
Number of Students	538	507	1014	220
Sum of Scores	2738	2569	5204	1170
Mean	5.09	5.07	5.13	5.32
Variance	1.87	1.84	1.87	1.67

Homogeneity of Variances = Fmax = 1.12

TABLE V (b)

SUMMARY OF ANALYSIS OF VARIANCE
FOR DATA OF TABLE V (a)

Source of Variation	Sum of Squares	Degrees of Freedom	Variance
Between Means	10.65	3	3.55
Within Conditions	4189.46	2275	1.84

F = 1.929 F .01 = 3.80 F .05 = 2.61

TABLE VI

GRADE IX SOCIAL STUDIES RESULTS CLASSIFIED
BY ENROLMENT OF THE MEDIAN-SIZED
CLASS TAUGHT BY THE TEACHER

Number of Students in Median Class	Stanine Scores on Examination 1	2	3	4	5	6	7	8	9	Totals
(1) 20 and under	1	2	37	68	86	65	28	7	0	294
(2) 21 to 25	0	11	27	62	90	83	46	12	0	331
(3) 26 to 30	2	12	63	118	157	140	71	26	2	591
(4) 31 and over	3	25	80	145	215	211	80	19	3	781
Totals	6	50	207	393	548	499	225	64	5	1997

$X^2 = 27.64$; df = 24; $.20 < p < .30$

VI. THE HOURS PER WEEK DEVOTED TO THE TEACHING JOB

Table VII shows the students' scores on the Grade IX social studies examination in 1958 as arranged according to the hours of work per week devoted to the teaching job by the teacher.

The chi-square test of independence shows a difference significant at the .05 level between the four groups of scores. The relatively large chi-square value largely results from the differences between three or

TABLE VI (a)

DATA FOR ANALYSIS OF VARIANCE: GRADE IX SOCIAL STUDIES
RESULTS CLASSIFIED BY ENROLMENT OF THE MEDIAN-SIZED CLASS
TAUGHT BY THE TEACHER

	Number of Students in Median Class			
	(1) 20 or under	(2) 21 to 25	(3) 26 to 30	(4) 31 and over
Number of Students	294	331	591	781
Sum of Scores	1460	1717	3035	3953
Mean	4.97	5.19	5.14	5.06
Variance	1.63	1.88	1.96	1.92

Homogeneity of Variances = Fmax = 1.2

TABLE VI (b)

SUMMARY OF ANALYSIS OF VARIANCE
FOR DATA OF TABLE VI (a)

Source of Variation	Sum of Squares	Degrees of Freedom	Variance
Between Means	9.51	3	3.17
Within Conditions	3796.27	1993	1.9

F = 1.67; F .01 = 3.80 F .05 = 2.61

TABLE VII

GRADE IX SOCIAL STUDIES RESULTS CLASSIFIED
BY HOURS PER WEEK DEVOTED TO THE
TEACHING JOB BY THE TEACHERS

Number of Hours Per Week	Stanine Scores on Examination 1	2	3	4	5	6	7	8	9	Totals
(1) 39 or less	0	14	50	88	147	130	60	12	0	501
(2) 40 to 49	4	25	116	261	352	320	129	22	4	1233
(3) 50 to 59	0	13	48	66	111	110	52	20	1	421
(4) 60 or more	2	0	11	17	19	31	16	7	0	103
Totals	6	52	225	432	629	591	257	61	5	2258

$X^2 = 39$; df = 24; $.01 < p < .05$

four small expected and observed frequencies. The more powerful test, analysis of variance (Tables VII (a) and VII (b)), shows an F value of 2.1 which is not significant. This indicates that there are no significant differences in examination scores between groups of students relative to the hours devoted by their teachers to the teaching job.

VII. THE NUMBER OF TEACHERS IN THE SCHOOL

Table VIII shows the students' scores on the Grade IX social studies final examination as arranged according to the number of teachers

TABLE VII (a)

DATA FOR ANALYSIS OF VARIANCE: GRADE IX SOCIAL STUDIES
RESULTS CLASSIFIED BY HOURS PER WEEK DEVOTED
TO THE TEACHING JOB BY THE TEACHERS

	Number of Hours Per Week			
	(1) 39 or less	(2) 40 to 49	(3) 50 to 59	(4) 60 or more
Number of Students	501	1233	421	103
Sum of Scores	2561	6241	2182	552
Mean	5.11	5.06	5.18	5.36
Variance	1.83	1.73	2.11	2.3

Homogeneity of Variances = Fmax = 1.33

TABLE VII (b)

SUMMARY OF ANALYSIS OF VARIANCE
FOR DATA OF TABLE VII (a)

Source of Variation	Sum of Squares	Degrees of Freedom	Variance
Between Means	11.51	3	3.84
Within Conditions	4105.69	2254	1.82

F = 2.11; F .01 = 3.80 F .05 = 2.61

TABLE VIII

GRADE IX SOCIAL STUDIES RESULTS CLASSIFIED
BY NUMBER OF TEACHERS IN THE SCHOOL

Number of Teachers	Stanine Scores on Examination									
	1	2	3	4	5	6	7	8	9	Totals
(1) 8 or fewer	1	9	49	70	121	100	41	8	0	399
(2) 9 to 12	3	8	46	111	115	90	44	9	2	428
(3) 13 to 24	2	24	92	180	252	228	101	21	1	901
(4) 25 or more	0	11	38	71	142	179	79	29	2	551
Totals	6	52	225	432	630	597	265	67	5	2279

$X^2 = 72.95$; $df = 24$; $.001 < p < .01$

in the school.

The chi-square test of independence shows significant differences among the examination scores. The more powerful test, analysis of variance (Table VIII (a) and VIII (b)), shows the value of F to be 15.5 which is significant at the .01 level. Tukey's gap test shows that a gap of .19 or greater is significant at the .05 level and a gap of .25 or greater is significant at the .01 level. Group (4) is found to differ significantly from all other groups. There are no significant differences among the other pairs of combinations.

TABLE VIII (a)

DATA FOR ANALYSIS OF VARIANCE: GRADE IX SOCIAL STUDIES
RESULTS CLASSIFIED BY NUMBER OF TEACHERS
IN THE SCHOOL

	Number of Teachers			
	(1) 8 or fewer	(2) 9 to 12	(3) 13 to 24	(4) 25 or more
Number of Students	399	428	901	551
Sum of Scores	2002	2114	4558	3007
Mean	5.02	4.94	5.06	5.46
Variance	1.73	1.84	1.8	1.78

Homogeneity of Variances = Fmax = 1.06

TABLE VIII (b)

SUMMARY OF ANALYSIS OF VARIANCE FOR
DATA OF TABLE VIII (a)

Source of Variation	Sum of Squares	Degrees of Freedom	Variance
Between Means	84.18	3	28.06
Within Conditions	4115.93	2275	1.81

F = 15.5; F .01 = 3.80

More specifically, the examination results are significantly higher in schools where there were twenty-five or more teachers as compared with schools with fewer teachers. The differences are not significant between schools of up to twenty-five teachers.

VIII. SEX OF THE TEACHER

Table IX shows the students' scores on the Grade IX social studies final examination arranged according to the sex of the teachers.

The chi-square test of independence shows no significant differences. An analysis of variance is not necessary as there are only two means to be compared. The t value of 1.88 can be obtained by taking the square root of F. This value is smaller than the t .05 value of 1.96 so there is no significant difference in students' results relative to the sex of their teachers.

TABLE IX

GRADE IX SOCIAL STUDIES RESULTS CLASSIFIED BY SEX OF TEACHERS

Sex of Teacher	Stanine Scores on Examination									
	1	2	3	4	5	6	7	8	9	Totals
(1) Male	4	29	139	254	373	339	138	39	2	1317
(2) Female	2	33	86	178	257	258	127	28	3	962
Totals	6	52	225	432	630	597	265	67	5	2279

$X^2 = 6.89$; df = 8; $.50 < p < .70$

TABLE X

DATA FOR COMPARISON OF MEANS: GRADE IX SOCIAL STUDIES
RESULTS CLASSIFIED BY SEX OF TEACHER

	Sex of Teacher	
	(1) Male	(2) Female
Number of Students	1317	962
Sum of Scores	6690	4991
Mean	5.08	5.19
Variance	1.82	1.84

Homogeneity of Variances = Fmax = 1.01

IX. THE TEACHERS' SUBJECT-FIELD PREFERENCE FOR TEACHING

Table XI shows the students' scores on the Grade IX social studies final examination arranged according to their teachers' subject-field preference for teaching. The chi-square test of independence shows a highly significant difference.

Table XII shows the means of the two groups of scores. The t value of 4.48 is well beyond the value of 2.58 required for significance at the .01 level. The Grade IX social studies final scores of students whose teachers preferred teaching in the social studies-English field are very much higher than those of students whose teachers preferred to teach in some other field.

TABLE XI

GRADE IX SOCIAL STUDIES RESULTS CLASSIFIED BY TEACHERS' SUBJECT-FIELD PREFERENCE FOR TEACHING

Teaching Preference	Stanine Scores on Examination									
	1	2	3	4	5	6	7	8	9	Totals
Social Studies-English	2	12	83	183	276	314	129	37	3	1039
Other	1	28	115	195	273	220	113	28	1	974
Totals	3	40	198	378	549	534	242	65	4	2013

$X^2 = 30.04$; df = 8; $.001 < p < .01$

TABLE XII

DATA FOR COMPARISON OF MEANS: GRADE IX SOCIAL STUDIES RESULTS CLASSIFIED BY TEACHERS' SUBJECT-FIELD PREFERENCE FOR TEACHING

	Teaching Preference	
	Social Studies-English	Other
Number of Students	1039	974
Sum of Scores	5497	4891
Mean	5.29	5.02
Variance	1.72	1.93

Homogeneity of Variances = Fmax = 1.12

X. ACADEMIC AND PROFESSIONAL TRAINING AND YEARS OF EXPERIENCE OF TEACHERS

Table XIII shows the data for the two-way analysis of variance of the students' scores on the Grade IX social studies examination arranged according to the academic and professional training and the

TABLE XIII

DATA FOR TWO-WAY ANALYSIS OF VARIANCE: GRADE IX SOCIAL STUDIES RESULTS CLASSIFIED HORIZONTALLY BY NUMBER OF YEARS OF TEACHING EXPERIENCE AND VERTICALLY BY NUMBER OF YEARS OF ACADEMIC AND PROFESSIONAL TRAINING OF TEACHERS

Years of Training		Years of Experience (1) 1 to 9	(2) 10 to 19	(3) 20 and over	Totals and Mean
(1) One or less (less than two)	Number of Students	279	229	118	626
	Sum of Scores	1330	1130	564	3024
	Mean	4.77	4.93	4.78	4.83
	Variance	1.69	2.02	1.64	
(2) Two or three (less than four)	Number of Students	137	248	376	761
	Sum of Scores	682	1229	1927	3838
	Mean	4.98	4.96	5.12	5.04
	Variance	1.67	1.61	1.91	
(3) Four or More	Number of Students	273	427	181	881
	Sum of Scores	1429	2313	1035	4777
	Mean	5.23	5.42	5.72	5.42
	Variance	1.84	1.69	1.6	
Total	Number of Students	689	904	675	2268
	Sum of Scores	3441	4672	3526	11639
	Mean	4.99	5.17	5.22	5.13

Homogeneity of Variance = Fmax = 1.26

teaching experience of their teachers. Table XIII (a) presents the summary of the analysis of variance of the data.[3]

TABLE XIII (a)

SUMMARY OF TWO-WAY ANALYSIS OF VARIANCE FOR DATA OF TABLE XIII

	Degrees of Freedom	Sum of Squares	Mean Square	Mean Square	Sum of Squares	Degrees of Freedom	
Experience Ignoring Training	2	22.48	11.24	66.35	132.71	2	Training Ignoring Experience
Interaction	4	18.7115	4.6779	4.6779	18.7115	4	Interaction
Training	2	130.2485	65.1242	10.0092	20.0185	2	Experience
Between Cells	8	171.44			171.44	8	
Within Cells	2259	3984.14	1.8307				
Total	2267	4155.58					

Variance ratio for interaction = $\frac{4.6779}{1.8307}$ = 2.56 F.01 = 3.32 F.05 = 2.37

[3]The method of two-way classification of analysis of variance with unequal numbers in the cells used here is described in C.R. Rao, Advanced Statistical Methods in Biometric Research (New York: John Wiley and Sons, Incorporated, 1952), pp. 94-102

The variance ratio for interaction is 2.56 which with 4 and 2259 degrees of freedom is significant at the .05 level.

Suppose that we ignore the training and look for experience differences. The analysis is as follows:

TABLE XIII (b)

ANALYSIS OF EXPERIENCE DIFFERENCES IGNORING TRAINING

	Degrees of Freedom	Mean Square	Ratio
Between Experience	2	11.24	6.18
Within Experience	2265	1.82	

which gives a significant ratio of 6.18. Similarly for training:

TABLE XIII (c)

ANALYSIS OF TRAINING DIFFERENCES IGNORING EXPERIENCE

	Degrees of Freedom	Mean Square	Ratio
Between Training	2	66.35	37.28
Within Training	2265	1.78	

which gives a highly significant ratio of 37.28.

This confirms what has already been established about the relationship between results of students and amount of training of teachers as related on pages 30 to 32, and as shown in Tables II, II (a), and II (b) on pages 30 and 31, and results of students and the number of years of experience of their teachers as related on pages 35 to 38 and as shown in Tables IV, IV (a) and IV (b), pages 36 and 37.

The variance ratio for interaction between these two factors indicates that there is a significant interaction. Training and experience acting together show a significant relation to the results of the students.

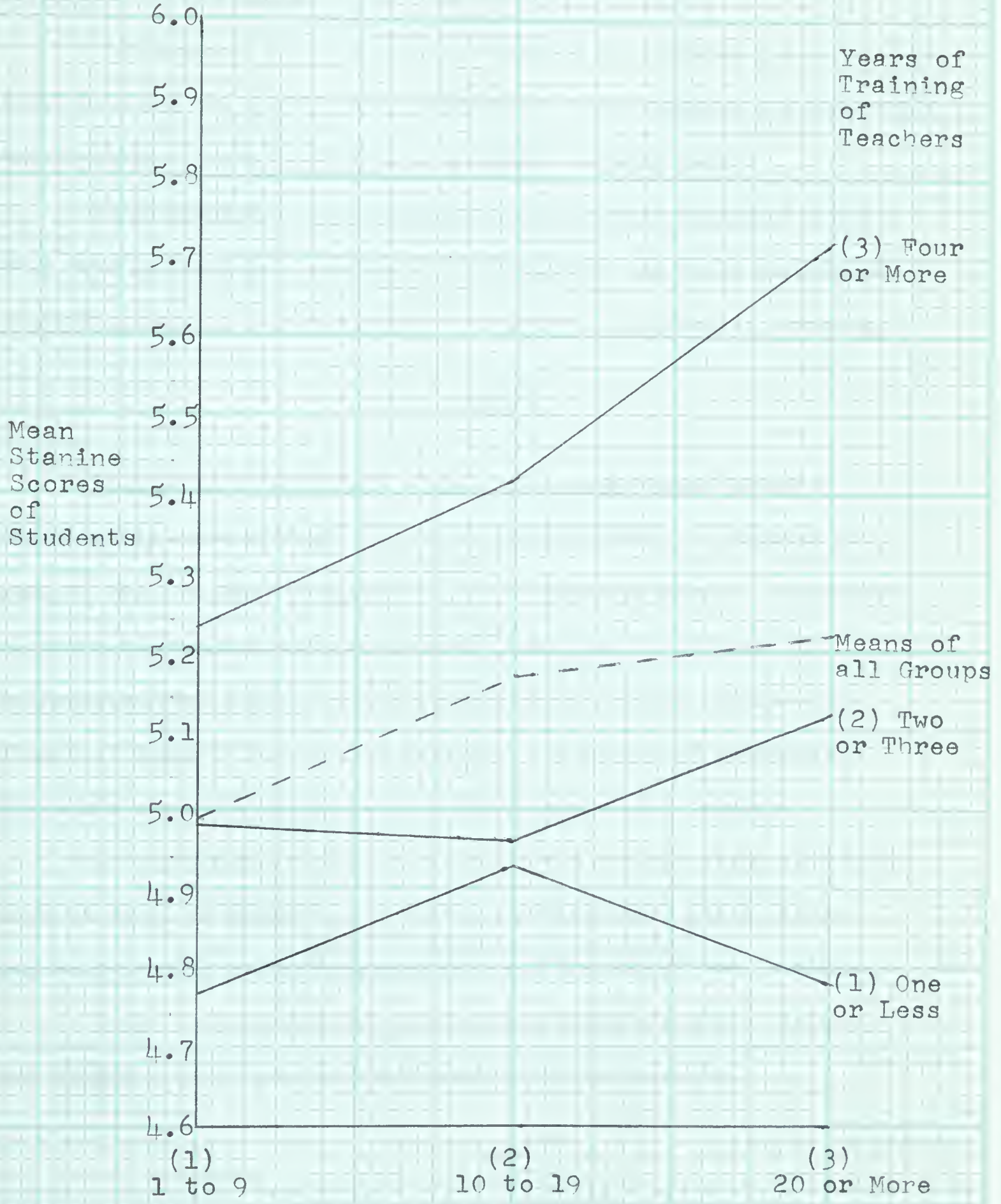
Figure I shows the data for two-way analysis of variance arranged in graph form. The mean results in social studies of students whose teachers had one or less years (less than two full years) of training increased from 4.77 to 4.93 as the teaching experience of teachers increased from one to nine to ten to nineteen years. The means then decreased to 4.78 as the experience of the teachers increased to twenty or more years.

The mean results of students whose teachers had two or three (but less than four) years of experience decreased from 4.98 to 4.96 as their teachers' experience increased from one to nine to ten to nineteen years. The mean increased to 5.12 as the experience of teachers increased to twenty or more years.

The mean results of the group of students whose teachers had four or more years of university training and one to nine years of

FIGURE I

Data for Two-Way Analysis of Variance in Graph Form



experience was 5.23. This increased to 5.42 as the experience of the teachers increased to ten to nineteen years. As the experience increased to twenty or more years the mean rose to 5.72.

The means of all the groups of scores of students increased from 4.99, to 5.17, to 5.22 as the experience of the teachers increased from one to nine, to ten to nineteen, to twenty or more years.

This shows that as experience increases the students' scores will tend to decrease, relative to the mean of the whole population, if their teachers have less than four years of university training.

XI. SUMMARY

This part of the study brings out a significant positive relationship between Grade IX social studies marks of students and each of the following characteristics of their teachers: the number of years of academic and professional training, the number of university-level content courses taken in the social studies, the number of years of teaching experience, the number of teachers in the school, and the subject-field preference of the teacher.

No significant differences were found between Grade IX social studies marks of students and the age, median-sized class, hours per week devoted to the teaching job, and the sex of the teachers.

There is a significant interaction between teacher training and teaching experience and the results of the students.

CHAPTER V

ANALYSIS AND INTERPRETATION OF DATA: THE SUBSIDIARY PROBLEMS

The questions of (1) whether there were any significant differences in the selected characteristics of teachers between city teachers and non-city teachers, and (2) whether there were any significant differences between students' results on the Grade IX social studies examination between students in city schools and students in non-city schools were explored in the subsidiary problems. This chapter shows the results of the analysis of data in respect to each of these problems.

The data relating to the first subsidiary problem are presented in contingency tables. The relationship between city teachers and non-city teachers is investigated by the chi-square method for each characteristic being compared. The numbers in the different tables vary as not all teachers answered all parts of the questionnaire.

The data relating to the second subsidiary problem are also presented in a contingency table.

I. THE FIRST SUBSIDIARY PROBLEM: DIFFERENCES BETWEEN CITY SCHOOL TEACHERS AND NON-CITY TEACHERS RELATIVE TO THE VARIOUS CHARACTERISTICS STUDIED

The Difference Relative to Extent of Academic and Professional Training

Table XIV compares city school teachers and non-city teachers with respect to the number of years of academic and professional training that they had beyond high school. The chi-square test of independence

shows a very significant difference between the two groups. City teachers exceeded non-city teachers in the length of their academic and professional training.

TABLE XIV

CITY SCHOOL TEACHERS COMPARED WITH NON-CITY SCHOOL TEACHERS RELATIVE TO NUMBER OF YEARS OF ACADEMIC AND PROFESSIONAL TRAINING BEYOND GRADE XII

	Number of Years of Training				
	One or Less	Two or Three	Four or Five	Six or More	Totals
City Teachers	3	5	9	2	19
Non-City Teachers	31	31	10	6	78
Totals	34	36	19	8	97

$X^2 = 12.92$; df = 3; $.001 < p < .01$

The Difference Relative to Number of Social Studies Courses Taken

Table XV compares the city and non-city teachers with respect to the number of university-level content courses which they have taken in the social studies. The chi-square test brings out no significant difference between city and non-city teachers relative to the number of university-level social studies courses which they have taken.

TABLE XV

CITY SCHOOL TEACHERS COMPARED WITH NON-CITY SCHOOL TEACHERS RELATIVE TO THE NUMBER OF UNIVERSITY-LEVEL COURSES TAKEN IN THE SOCIAL STUDIES

	Number of Courses				
	None	One or Two	Three or Four	Five or More	Totals
City Teachers	4	3	3	5	15
Non-City Teachers	20	15	5	4	44
Totals	24	18	8	9	59

$X^2 = 6.64$; df = 3; $.05 < p < .10$

The Difference Relative to Teaching Experience

Table XVI compares the city school teachers and non-city school teachers with respect to the number of years of full-time teaching experience which they have had. The chi-square test brings out no significant difference between the two groups.

The Difference Relative to the Age of Teachers

Table XVII shows the city school teachers compared with non-city school teachers in relation to age of teachers (to the nearest birthday).

The chi-square test fails to bring out any significant difference between the two groups of teachers. City teachers and non-city teachers did not differ significantly with respect to age.

TABLE XVI

CITY SCHOOL TEACHERS COMPARED WITH NON-CITY SCHOOL TEACHERS RELATIVE TO NUMBER OF YEARS OF TEACHING EXPERIENCE

	Number of Years of Experience				
	1 to 4	5 to 14	15 to 24	25 and over	Totals
City Teachers	4	5	8	2	19
Non-City Teachers	14	34	15	14	77
Totals	18	39	23	16	96

$X^2 = 4.94$; df = 3; $.10 < p < .20$

TABLE XVII

CITY SCHOOL TEACHERS COMPARED WITH NON-CITY SCHOOL TEACHERS RELATIVE TO AGE

	Age of Teacher (in Years)				
	Up to 30	31 to 40	41 to 55	56 and up	Totals
City Teachers	8	2	8	1	19
Non-City Teachers	16	26	29	7	78
Totals	24	28	37	8	97

$X^2 = 6.02$; df = 3; $.10 < p < .20$

The Difference Relative to the Enrolment of the Median-Sized Class

Table XVIII compares the city school teachers with the non-city school teachers with respect to the enrolment of the median-sized class.

The chi-square test brings out a significant difference between the two groups of teachers. City school teachers had a larger median class than non-city school teachers.

TABLE XVIII

CITY SCHOOL TEACHERS COMPARED WITH NON-CITY SCHOOL TEACHERS RELATIVE TO ENROLMENT OF THEIR MEDIAN-SIZED CLASS

	Number of Students in Median-Sized Class				
	20 or Under	21 to 25	26 to 30	31 and Over	Totals
City Teachers	0	3	3	11	17
Non-City Teachers	30	11	12	6	59
Totals	30	14	15	17	76

$X^2 = 26.3$; df = 3; $.001 < p < .01$

The Difference Relative to the Average Number of Hours per Week Devoted to the Teaching Job

Table XIX shows the city school teachers and the non-city school teachers compared with respect to the average number of clock hours per week that they devoted to the teaching job whether this was done at

school or elsewhere.

The chi-square test brings out no significant difference between the two groups. City and non-city teachers do not differ significantly with respect to the average number of hours devoted to the teaching job.

TABLE XIX

CITY SCHOOL TEACHERS COMPARED WITH NON-CITY SCHOOL TEACHERS RELATIVE TO NUMBER OF CLOCK HOURS PER WEEK DEVOTED TO THE TEACHING JOB

	Number of Hours Per Week				
	39 or Less	40 to 49	50 to 59	60 or More	Totals
City Teachers	4	13	2	0	19
Non-City Teachers	12	40	17	8	77
Totals	16	53	19	8	96

$X^2 = 3.88$; df = 3; $.20 < p < .30$

The Difference Relative to the Number of Teachers in the School

Table XX shows the city school teachers compared with non-city school teachers with respect to the number of teachers there were in the schools in which they taught.

The chi-square test brings out a very significant difference between the two groups. The city teachers taught in larger schools (measured in terms of number of teachers per school) than the non-city teachers.

TABLE XX

CITY SCHOOL TEACHERS COMPARED WITH NON-CITY SCHOOL TEACHERS RELATIVE TO NUMBER OF TEACHERS IN THE SCHOOL

	Number of Teachers in School				
	8 or fewer	9 to 12	13 to 24	25 or More	Total
City Teachers	1	2	10	6	19
Non-City Teachers	49	13	12	4	78
Totals	50	15	22	10	97

$X^2 = 29.57$; $df = 3$; $.001 < p < .01$

The Difference Relative to the Sex of the Teacher

Table XXI shows the city school teachers and the non-city school teachers compared with respect to sex.

The chi-square test fails to bring out any significant difference between the two groups of teachers. City and non-city school teachers did not differ significantly with respect to sex.

The Difference Relative to Teaching Preference

Table XXII compares city school teachers and non-city school teachers with respect to their subject-field preference for teaching.

The chi-square test shows a very significant difference between the two groups. City teachers teaching social studies had a significantly

TABLE XXI

CITY SCHOOL TEACHERS COMPARED WITH NON-CITY SCHOOL TEACHERS RELATIVE TO SEX

	Sex		
	Male	Female	Totals
City Teachers	11	8	19
Non-City Teachers	51	27	78
Totals	62	35	97

$X^2 = .34$; df = 1; $.50 < p < .70$

TABLE XXII

CITY SCHOOL TEACHERS COMPARED WITH NON-CITY SCHOOL TEACHERS RELATIVE TO SUBJECT-FIELD TEACHING PREFERENCE

	Teaching-Field Preference		
	English-Social Studies	Other	Totals
City Teachers	12	4	16
Non-City Teachers	26	49	75
Totals	38	53	91

$X^2 = 8.75$; df = 1; $.001 < p < .01$

higher preference for the English-social studies field than non-city teachers of social studies.

II. THE SECOND SUBSIDIARY PROBLEM: DIFFERENCE BETWEEN CITY STUDENTS AND NON-CITY STUDENTS RELATIVE TO RESULTS IN THE SOCIAL STUDIES EXAMINATION

Table XXIII shows the data relating to the second subsidiary problem. The students are classified vertically into two groups: city students and non-city students. They are divided horizontally into nine categories according to their stanine scores on the final examination (as adjusted - see Appendix C).

The chi-square test of independence indicates a very significant difference between the two groups of students with respect to examination results. City students made significantly higher scores than non-city

TABLE XXIII

CITY STUDENTS COMPARED WITH NON-CITY STUDENTS RELATIVE TO EXAMINATION RESULTS IN GRADE IX SOCIAL STUDIES

	Stanine Scores on Examination									
	1	2	3	4	5	6	7	8	9	Totals
City Students	2	24	74	173	267	273	99	18	3	933
Non-City Students	4	28	151	259	363	324	166	49	2	1346
Totals	6	52	225	432	630	597	265	67	5	2279

$X^2 = 20.83$; df = 8; $.001 < p < .01$

students.

City teachers of Grade IX social studies in 1958 compared with non-city teachers had more years of training, a greater preference for teaching in the social studies-English field and there were more teachers in the school. The findings of this study indicate that these characteristics have a significant positive relationship with student marks. The fact that city students achieved higher scores in social studies can therefore be attributed to these three significantly different teacher characteristics.

III. SUMMARY

The statistical analysis shows that the city teachers surpassed non-city teachers in number of years of academic and professional training, number of students in the median-sized class, number of teachers in the school, and subject-field preference. The two groups did not differ significantly in the number of university-level social studies courses taken, number of years of teaching experience, age of the teacher, number of hours per week devoted to teaching, or sex of the teacher.

City students made significantly higher scores on the Grade IX social studies examination than non-city students.

CHAPTER VI

SUMMARY, CONCLUSIONS, AND IMPLICATIONS

I. SUMMARY AND CONCLUSIONS

This study attempted to compare certain objectively measurable factors with teacher effectiveness by comparing certain characteristics of Grade IX social studies teachers in Alberta with the final examination results of their students in social studies.

The review of the literature shows that although a number of studies have investigated these factors, there appears to be no general agreement on the significance of many of the teacher characteristics studied in relation to the product of the teaching, measured here by student marks in social studies.

The two subsidiary problems in this study investigated the differences in the specific teacher characteristics between city and non-city teachers, and the differences in student scores between city and non-city students. The data were arranged in contingency tables and the probabilities were investigated by chi-square tests of independence.

The technique of analysis of variance was applied to the data for the main problem which compared these teacher characteristics with student marks.

The following are the more important findings and conclusions:

1. There was a significant positive relation between Grade IX social studies marks made by pupils and the number of years of academic and professional training of, the number of university-level courses

taken in the social studies by, the number of years of teaching experience of, and the subject-field preference of their teachers, and also the number of teachers in the school.

2. There was no significant relation between social studies marks of students and the age, median-sized class, hours per week devoted to the teaching job, and the sex of their teachers.

3. There was a significant interaction between amount of teacher training and length of teaching experience.

4. City teachers of social studies surpassed non-city teachers in number of years of academic and professional training, number of students in the median-sized class, number of teachers in the school, and subject-field preference for teaching in the English-social studies field.

5. There was not a significant difference between city teachers and non-city teachers in relation to the number of university-level social studies courses taken, number of years of teaching experience, age, number of hours per week devoted to teaching, and sex.

6. City students made significantly higher scores on the Grade IX social studies examination than non-city students.

The teacher characteristics which have a significant positive relationship with Grade IX student marks in social studies and are also significantly different between city and non-city teachers are the following: city teachers have more years of teacher training and a greater preference for teaching in their subject field, and

there are more teachers in the city schools than in the non-city schools.

It appears, then, that the reason city students obtain higher social studies marks than non-city students is that their teachers surpassed the non-city teachers in the above characteristics.

The following conclusions from the studies by Lindstedt and Wasylyk are further reinforced by the findings of this study:

1. There was a significant relation between students' results on the final examination and each of the following: length of academic and professional training of teachers beyond Grade XII, the number of years of teaching experience, and the subject-field preference for teaching.

2. City school teachers and non-city school teachers differed significantly in the length of their academic and professional training.

Both of the aforementioned studies found a significant interaction between amount of academic and professional training and length of teaching experience. The present study also found such a significant interaction.

Both the studies by Lindstedt and Wasylyk found a significant difference between city school teachers and non-city school teachers relative to the number of university-level mathematics courses taken. This study found no such significant difference relative to the number of university-level social studies courses taken by the teachers.

II. IMPLICATIONS

There are some rather definite implications to be gathered from the above summary and conclusions. These can be classified according to implications for further research, for selection and recruitment of teachers, for teacher training, for teacher placement, and for payment of teachers.

Further Research

Downey reported in 1960 that Canadians (in Alberta), as a group, assigned considerably higher priority than did Americans to such things as knowledge and scholarly attitudes.[1] This may lead to rather different results in Canadian teacher effectiveness studies than in similar studies in the United States. There is, therefore, even more need for further research in the field of teacher effectiveness, particularly the effectiveness of Alberta teachers. Such studies could be carried out in other subject areas, and at various grade levels. Studies such as the present one and the studies by Lindstedt and Wasylyk do not agree on all the findings. More such studies may bring out some definite pattern with respect to teacher effectiveness.

Selection and Recruitment of Teachers.

The results of this study imply that school administrators who are looking for effective teachers of Grade IX social studies should look

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[1] L.W. Downey, "Regional Variations in Educational Viewpoint," Alberta Journal of Educational Research, VI (December, 1960), 197

for the following: teachers with more years of academic and professional training, more university-level courses taken in the social studies, more years of teaching experience, and with a preference for teaching in the English-social studies field.

The study suggests that teachers with four or more years of training and no experience are more effective than teachers with less than four years of training and any amount of experience. The difference becomes even more marked as the teachers with four or more years of training gain in experience.

Training of Teachers

The implications in this study for people in charge of teacher training institutions and those in a position to make recommendations about teacher training programs are that it is desirable for teachers of Grade IX social studies to have four or more years of training, including three or more content courses in the social studies.

Placement of Teachers

School administrators and those in charge of teacher placement will find an important implication in this study: that teachers appear to do most effective teaching in the subject-field area in which they prefer to teach.

While many of the teachers reported in this study no doubt taught in their subject preference area as well as other areas, most teachers teaching social studies preferred to teach in some other area. Specifically 25 per cent in city schools and 65.3 per cent in non-city

schools for an astonishing total of 58.2 per cent of the teachers in the survey had a teaching preference in some subject-field other than English-social studies.

Another implication of this study is that once teachers are selected they seem to do more effective teaching when placed in schools which have twenty-five or more teachers.

Payment of Teachers

This study implies that there is some basis for the present practice of paying teachers according to years of training and years of experience. The important step in training is at the four year or degree level. Perhaps, though, the length of experience recognized for salary purposes should be longer than is normally the case at present, and the amount paid for length of teaching experience should be greater for teachers with four or more years of training than for teachers with less training.

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APPENDIXES

APPENDIX A

EXCERPTS FROM THE PROVINCE OF ALBERTA ROYAL COMMISSION ON EDUCATION SURVEY OF ALBERTA TEACHER FORCE INDIVIDUAL TEACHER'S REPORT

Data for teachers were obtained from the Province of Alberta Royal Commission on Education Survey of Alberta Teacher Force Individual Teacher's Report. The following items from the questionnaire were used in this study:

4. If you teach more than one class, what is the ENROLMENT of the median-sized (middle-sized) CLASS which you teach? Consider a class to be defined as in Question 3. Check ONE.

1. ... Under 10 pupils	6. ... 31 to 35 pupils
2. ... 11 to 15 pupils	7. ... 36 to 40 pupils
3. ... 16 to 20 pupils	8. ... 41 to 45 pupils
4. ... 21 to 25 pupils	9. ... Over 45 pupils
5. ... 26 to 30 pupils	

3. Definition of class: If you supervise some pupils while teaching others, consider a class to be the total number of pupils for whom you have sole charge in your room at any one time.

6. What is the average NUMBER of CLOCK HOURS per week that you devote to your teaching job? Include all time spent in activities which are required or definitely expected of you, whether you do your work at home, at school, or elsewhere. Check ONE.

1. ... Under 30 hours	6. ... 50 to 54 hours
2. ... 30 to 34 hours	7. ... 55 to 59 hours
3. ... 35 to 39 hours	8. ... 60 to 64 hours
4. ... 40 to 44 hours	9. ... 65 or more
5. ... 45 to 49 hours	

9. How many TEACHERS are there in the SCHOOL in which you teach? Be sure to include the principal and yourself. If you don't know exactly, make the best estimate you can. Check ONE.

1. ... 1 teacher
2. ... 2 teachers
3. ... 3 teachers
4. ... 4 to 8 teachers
5. ... 9 to 12 teachers
6. ... 13 to 24 teachers
7. ... 25 to 49 teachers
8. ... 50 to 99 teachers
9. ... 100 or more

11. In what TYPE OF ADMINISTRATIVE UNIT is your school? If it is in a School Division or County, check under A. If it is in an Independent (Non-Divisional) District, check ONE under B.

A. ... In a School Division or County.

B. In an Independent (Non-Divisional) District.

1. ... A City District (not R.C. Separate)
2. ... A Town District (not R.C. Separate)
3. ... A Village District (not R.C. Separate)
4. ... A Consolidated District (not R.C. Separate)
5. ... A Rural School District (not R.C. Separate)
6. ... A City District (R.C. Separate)
7. ... A Town District (R.C. Separate)
8. ... A Village or Rural District (R.C. Separate)
9. ... Other (Please write in)

15. What is the EXTENT of your TOTAL ACADEMIC and PROFESSIONAL PREPARATION BEYOND HIGH SCHOOL? Check ONE.

1. Less than a standard 1-year program (7 months) in a Normal School, Teachers' College, or University.
2. A standard 1-year program (7 months or more) in a Normal School, Teachers' College, or University.
3. 2 complete years but less than 3 in a University and/or Teachers' College.
4. 3 complete years but less than 4 in a University and/or Teachers' College.
5. 4 complete years but less than 5 in a University and/or Teachers' College.
6. 5 complete years but less than 6 in a University and/or Teachers' College.
7. 6 or more complete years in a University and/or Teachers' College.

25. In which of Grades VII to XII are you teaching SOCIAL STUDIES? Check ALL grades in which you are teaching SOCIAL STUDIES.

1. ... None of Grades VII to XII
2. ... Grade VII
3. ... Grade VIII
4. ... Grade IX
5. ... Grade X
6. ... Grade XI
7. ... Grade XII

26. (a) How many University or College CONTENT COURSES have you COMPLETED IN THE SOCIAL STUDIES? Encircle ONE.

None 1 2 3 4 5 6 7 8+

40. In which of the following subject areas would you PREFER to teach? Check ONE.

1. ... English - Social Studies (Jr. or Sr. High).
2. ... Mathematics - Science (Jr. or Sr. High).
3. ... Foreign Languages (Jr. or Sr. High).
4. ... Fine Arts (Jr. or Sr. High).
5. ... Physical Education (Jr. or Sr. High).
6. ... Indus. Arts - Home Ec. (Jr. or Sr. High).
7. ... Commercial Subjects (Jr. or Sr. High).
8. ... Grades I, II, or III.
9. ... Grades IV, V, or VI.
10. ... Other (Please write in) .....

41. Counting the present school year, what is the TOTAL NUMBER of SCHOOL YEARS of full-time teaching experience you have had? Check ONE.

1. ... 1 year
2. ... 2 years
3. ... 3 to 4 years
4. ... 5 to 9 years
5. ... 10 to 14 years.
6. ... 15 to 19 years
7. ... 20 to 24 years
8. ... 25 to 34 years
9. ... Over 34 years.

51. Please indicate your SEX. Check ONE.

1. ... Male
2. ... Female

53. What is your AGE (nearest birthday)? Check ONE.

1. ... Under 21 years
2. ... 21 to 25 years
3. ... 26 to 30 years
4. ... 31 to 35 years
5. ... 36 to 40 years
6. ... 41 to 45 years
7. ... 46 to 55 years
8. ... 56 to 65 years
9. ... 66 or over

APPENDIX B

GRADE IX EXAMINATION SCORES

Data for the students were obtained from the Alberta Department of Education records where 1957-58 Grade IX examination marks are shown according to the following report which was sent to school principals in Alberta in July, 1957.

Grade IX Examination Summary Report

As in 1956, Grade IX examination summary reports will show two gradings for each examination. These gradings will be (1) letter gradings (H, A, B, C, D) and (2) stanines.

(1) The letter gradings are awarded according to the following table:

Grading	Percentage of students in each group
H	10
A	25
B	35
C	20
D	10

(2) The stanine method of reporting divides the scores into nine groups which are approximately equal units on the base of the normal curve scale. The percentage (approximate) of scores in each stanine is as follows:

Stanine	Percentage
9	4
8	7
7	12
6	17
5	20
4	17
3	12
2	7
1	4
	100

In other words, the lowest 4 percent of raw scores are included in the first stanine; the next 7 percent in the second stanine; the next 12 percent in the third stanine, etc.

APPENDIX C

ADJUSTMENT OF EXAMINATION SCORES

The School and College Ability Test (SCAT) used to measure ability of Grade IX students in 1958, to some extent also measures skills and abilities beyond academic aptitude, but it was used in this study because it was the only available measure of student ability for the whole sample of students.

Table XXIV shows the students' scores on the 1958 social studies examination and their scores on the mental ability test. The data used in adjusting the scores are shown in the table and relevant data following the table.[1]

If Yi is the ith social studies score and Xi the ith mental ability score, and if Yi is considered as consisting of two parts, that is if

$$Yi = Yi^{1} = Ri$$

where

$$Yi^{1} = a + bXi = \bar{Y} + b(Yi - \bar{X})$$

is the predicted Y based on X, and Ri is the residual containing those contributions to Yi not explained by linear regression of Y on X, then the quantity

$$Zi = Yi + (\bar{Y} - Yi^{1}) = \bar{Y} + Ri$$

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[1]The method used here and the following proof were taken from E. Wasylyk, "The Relation Between Four Selected Teacher Characteristics and Student Achievement in Grade Twelve Mathematics" (unpublished Master's thesis, The University of Alberta, Edmonton, Alberta, 1960), pp. 93-94.

is the transformation of Yi that is uncorrelated with Xi.

Proof: From the definition of Zi, it is easily shown that $\bar{Z} = \bar{Y}$

Therefore $Zi - \bar{Z} = Yi + (\bar{Y} - Yi^1) - \bar{Y}$

$$= Yi - Yi^1$$

$$= Yi - (\bar{Y} + b(Xi - \bar{X}))$$

$$= (Yi - \bar{Y}) - b(Xi - \bar{X})$$

Multiplying this equation by $(Xi - \bar{X})$, summing over the interval $i = 1$ to $i = N^1$, and dividing by N, in turn yields

$$\frac{1}{N}\sum(Zi - \bar{Z})(\bar{Xi} - \bar{X}) = \frac{1}{N}\sum(Yi - \bar{Y})(Xi - \bar{X}) - \frac{1}{N} b \sum(Xi - \bar{X})^2$$

$$\text{or } S_{ZX} = S_{XY} - bS_X^2$$

But $b = \frac{SXY}{S^2X}$ so that $S_{XY} = bS^2X$ and therefore $S_{ZX} = 0$

Now the correlation, r, between Z and X is given by $r = \frac{S_{ZX}}{S_Z S_X}$

and since $S_{ZX} = 0$, it follows that $r = 0$. Hence the Zi and the Xi are uncorrelated, and Z can be regarded as a measure of social studies achievement when mental ability is constant.

We find that $$Y^1 = r\frac{SDY}{SDX}(X - \bar{X}) + \bar{Y} = 1.44 + .72X$$

so, $$Z = Y + (\bar{Y} - Y^1)$$

$$= Y + (5.1 - (1.44 + .72X))$$

$$= Y - .72X + 3.66$$

TABLE XXIV

CORRELATION TABLE OF STUDENTS' RESULTS ON THE GRADE IX SOCIAL STUDIES AND MENTAL ABILITY EXAMINATIONS

Stanine Scores on Social Studies Examination (Y)	Stanine Scores on Mental Ability Examination (X) 1	2	3	4	5	6	7	8	9	Totals
9					1	6	17	35	37	96
8				3	12	24	49	60	20	168
7			1	9	46	83	80	42	22	283
6		6	11	32	112	111	95	19	8	394
5	6	8	55	109	136	98	41	17	2	472
4	16	38	64	77	102	63	21	1		382
3	14	48	74	56	48	12	5			257
2	27	30	28	39	19	1	2			146
1	36	18	11	13	3					81
Totals	99	148	244	338	479	398	310	174	89	2279

$N = 2279$

$\bar{X} = 5.08$ $\quad \bar{Y} = 5.1$

$SD_X = 1.97$ $\quad SD_Y = 1.94$

$r = .73$

Taking as an example the seventeen students with a social studies stanine score of five and a mental ability score of eight, we find,

$$Z = 5 - .72(8) + 3.66$$

$$= 5 - 5.76 + 3.66$$

$$= 5 - 2.1$$

$$= 2.9$$

$$= 3 \text{ (to the closest whole number)}$$

The social studies score of five is average, but because the students had a higher than average ability score of eight, the adjusted score of three is below average.

APPENDIX D

ASSUMPTIONS UNDERLYING THE ANALYSIS OF VARIANCE

The following assumptions are made in the mathematical development of the analysis of variance:

1. The distribution of the variables in the populations from which the samples are drawn is normal.

2. The variances in the populations from which the samples are drawn are equal. This is known as homogeneity of variance.

3. The effects of various factors on the total variation are additive.[1]

In this study there is no reason to suspect a fairly extreme departure from normality. Lindquist says:

> Unless the departure from normality is so extreme that it can be easily detected by more inspection of the data, the departure from normality will probably have no appreciable effect on the validity of the F-test, and the probabilities read from the F-table can be used as close approximations to the true probabilities.[2]

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[1]These assumptions are discussed in G.A. Ferguson, Statistical Analysis in Psychology and Education (Toronto: McGraw-Hill Book Co., Inc., 1959), pp. 239-240.

[2]E.F. Lindquist, Design and Analysis of Experiments in Psychology and Education (Boston: Houghton Mifflin Co., 1953), p. 86.

A maximum F-ratio test as described by Walker and Lev was used. According to this test the value of F is calculated by taking the ratio of the largest subgroup variance to the smallest subgroup variance. If this ratio is sufficiently great to yield a significant value for F it cannot be assumed that the subgroups are internally homogeneous. To explore this possibility a maximum F test of homogeneity was carried out for each of the measures of effectiveness. The variances of the groups are quite homogeneous in all cases.[3]

Additivity of effects has been assumed.

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[3]H. M. Walker and Joseph Lev, Statistical Inference. (New York: Henry Holt and Co., 1953), pp. 191-192.

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